

# A New Species of Intertidal *Terebra* from Brazil

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## ABSTRACT

*Terebra imitatrix* new species is described from northern Brazil and compared to morphologically similar species of *Hastula*. The three known terebrid feeding types are briefly reviewed. Dissection of the foregut of this new species revealed characters that overlap two of the major feeding types.

**Key words:** Gastropoda; Terebridae; *Terebra*; anatomy; Brazil.

## INTRODUCTION

While compiling distributional records of the West Atlantic *Hastula cinerea* species group, the junior author located an unidentified lot of 23 specimens from Brazil in the Academy of Natural Sciences of Philadelphia (ANSP 299957). These specimens were compared to the known terebrids from the Atlantic and were found to belong to a distinct undescribed species. An additional lot of the same species was subsequently found in the American Museum of Natural History (AMNH 129280). Matthews *et al.* (1975:99, fig. 31) in their treatment of *Hastula cinerea* describe and illustrate a protoconch consistent with this new species. The Brazilian specimens of *Hastula salleana* (Deshayes, 1859) figured by Rios (1970: 123, pl. 47, 1975:127, pl. 38, fig. 560, 1985:131, pl. 45) are probably referable to this new species, but the figured specimen was unavailable for examination. This paper describes this new species and compares it with morphologically similar species of *Hastula*. A description of the foregut anatomy reveals that it does not conform to any of the three known feeding types, which are reviewed herein.

## MATERIALS AND METHODS

Only shells possessing 10 or more teleoconch whorls and with intact protoconchs and apertures were measured with Vernier calipers. All dissections were made under a Wild M-5 dissecting microscope and line drawings made with the aid of a camera lucida. Description and discussion of the anatomy is limited to the foregut due to poor preservation in the upper whorls. Anatomical and protoconch measurements were made with an ocular

micrometer and converted to millimeters. Terminology follows that of Miller (1970, 1971). Two preserved but completely retracted adult specimens of the new species (ANSP 299957), *Hastula maryleeae* Burch (UF 113539) and *Hastula salleana* (Deshayes) (UF 48197, 113540), were dissected from each lot. Two dried-in specimens of *Hastula maryleeae* Burch (T. Bratcher collection) were rehydrated in a weak solution of potassium hydroxide, transferred into water, and dissected. The radular sac was extracted and dissolved in a weak solution of potassium hydroxide. Radular teeth were individually mounted on scanning electron microscope specimen stubs covered with double-sided tape. Micrographs were made with a Hitachi 5-415A scanning electron microscope.

Repositories of examined specimens are indicated by the following abbreviations:

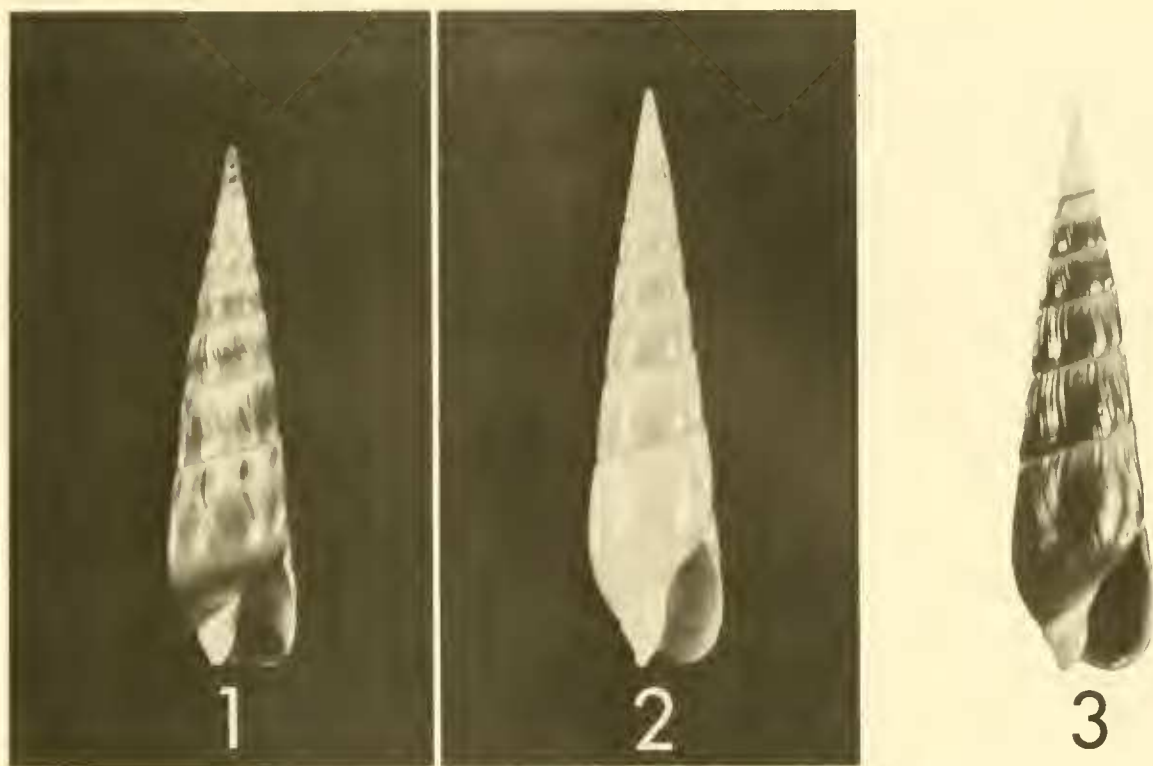
AMNH American Museum of Natural History  
ANSP Academy of Natural Sciences of Philadelphia  
UF Florida Museum of Natural History

## SYSTEMATICS

Family Terebridae Mörch, 1852  
Genus *Terebra* Bruguière, 1789

*Terebra imitatrix* new species  
(figures 1-6, 8, 9, table 1)

**Description:** Shell (figures 1-3, 6) medium in size, broadening anteriorly; color variable, ranging from banded, or cream, to purplish-brown; teleoconch whorls 10-12; sides flat to slightly convex. Protoconch whorls 1.5-2.0; glassy, transparent (figure 6). Axial sculpture of close-set, recurved ribs of variable strength, generally distinct near the suture, becoming obsolete anteriorly; major axial ribs 34-57 ( $\bar{x}$  = 41.6) on the penultimate whorl. Spiral sculpture of very faint microscopic incised lines most distinct in the intercostal spaces on the upper whorls, obsolete on later whorls, rarely crossing the axial ribs; spiral rows of pits absent. Last whorl with obsolete axial ribs and spiral incised lines; color pattern variable, typically of five diffuse color bands: one white pre-sutural band usually with distinct brown spots that become obsolete toward apertural lip, one broad bluish-black zone at shoulder, one pinkish band at periphery, one purplish-



Figures 1-3. *Terebra imitatrix* new species. 1. Holotype, ANSP 299957 (27.5 mm shell length). 2, 3. Paratypes, ANSP 369293, all from Rio Grande do Norte, Brazil, sand island at mouth of the inlet at Areia Branca.

brown band below periphery, and one white basal zone. Columella brown, centrally concave and slightly re-curved; rounded rib present on anterior edge. Parietal callus thin, transparent to light brown. Fasciole white to bluish-gray with distinct white rib. Anterior siphonal notch moderately broad, straight. Aperture light to dark brown with white band.

**External anatomy:** Animal cream-colored with no apparent pattern in alcohol-preserved specimens. Operculum corneous, small, thin. Eyes on short, broad eye-stalks. Labial tube large, spoon-shaped (figure 4). Anterior end of labial tube terminating in thick muscular lips bounding mouth slit; well-developed sphincter lacking.

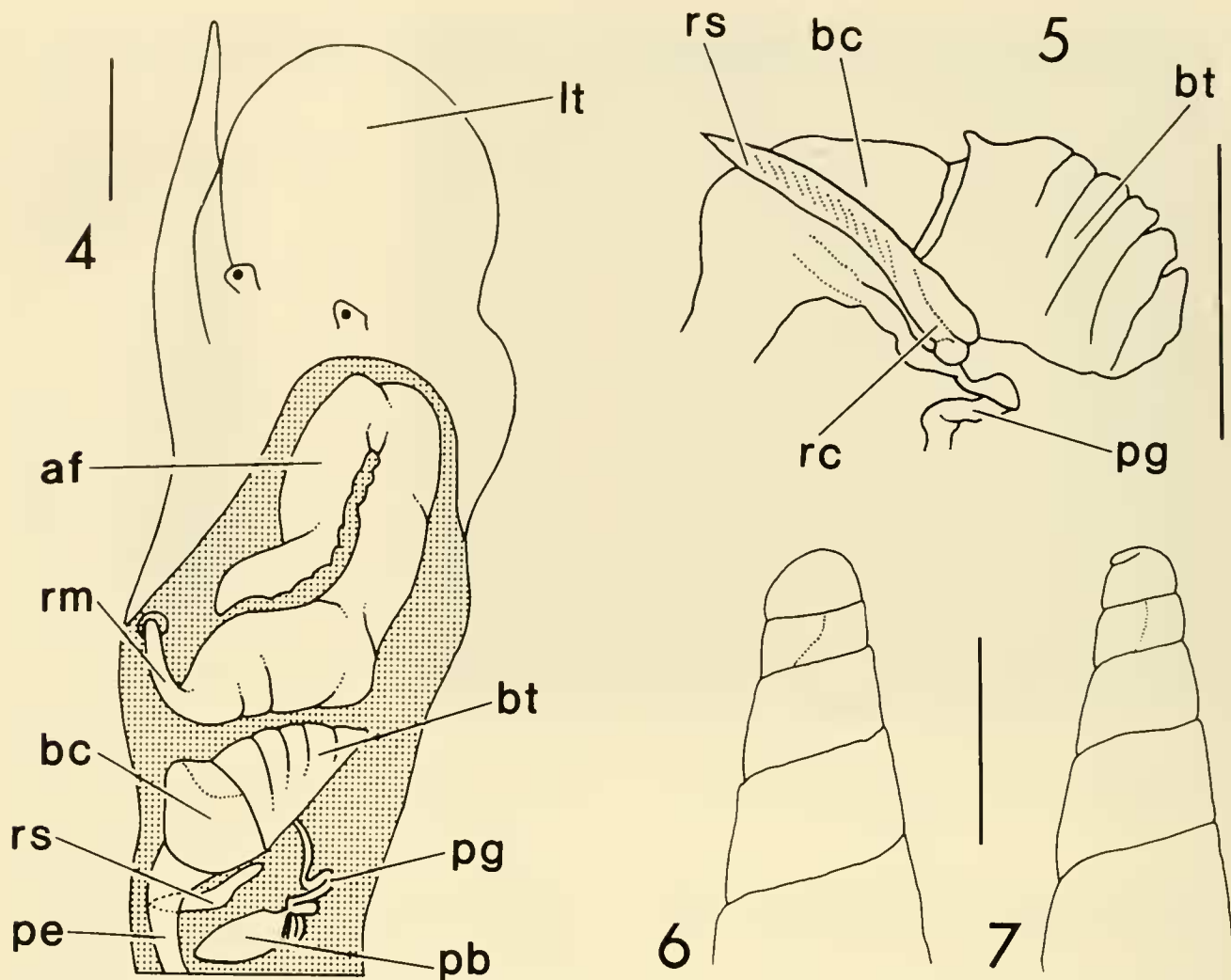
**Foregut anatomy:** Labial cavity large, dominated by massive (3.7 mm), extendable, muscular organ (accessory feeding apparatus; Miller, 1970, 1971) that tapers anteriorly; muscular organ with two rows of papillae on ventral side (figure 4); attached posteriorly to the left side of the cephalic hemocoel by connective tissue; retractor muscle large, originating in foot below and slightly posterior to anterior siphon, passing through cephalic hemocoel. Buccal tube muscular, short (0.9 mm), tapering anteriorly. Buccal cavity small (0.6 mm), rounded. Pre-ganglionic esophagus enters buccal mass posteriorly (figure 4). Salivary glands not located. Radular sac blade-shaped, small (0.8 mm). Radular caecum (0.4 mm) with well-developed groove running posteriorly, two distinct

bulbs anteriorly (figure 5). Radular organs attached to right side of anterior portion of buccal cavity by very short duct (0.1 mm). Two rows of radular teeth situated obliquely in radular sac and caecum (figure 5). Radular teeth about 30; 0.1-0.2 mm in length, slightly curved, not barbed (figures 8, 9). Poison gland long (6.2 mm), extremely convoluted, entering right side of buccal cavity slightly behind radular sac (figure 5). Poison bulb small (0.9 mm), weak, seemingly vestigial, lying at ventro-posterior end of cephalic hemocoel.

**Etymology:** From the Latin feminine noun meaning one who imitates, in reference to the deceptively close resemblance of the shell to that of *Hastula cinerea* (Born, 1778), with which it occurred in the type lot.

Table 1. Measurements (mm) of shell characters of *Terebra imitatrix* new species and *Hastula maryleeae* Burch.

Species	Character	$\bar{x}$	Range	SD
<i>T. imitatrix</i>	Shell length	27.3	24.1-29.7	1.9
	Shell width	6.4	5.7-7.4	0.5
	Protoconch width	0.50	0.46-0.52	0.03
<i>H. maryleeae</i>	Shell length	18.2	15.0-24.1	2.7
	Shell width	4.6	3.7-5.5	0.6
	Protoconch width	0.40	0.38-0.42	0.02



Figures 4–6. *Terebra imitatrix* new species. 4. Diagrammatic dorsal view of the organs of the foregut. 5. Right side of the buccal tube showing radular organs and insertion of the poison gland. 6. Protoconch. 7. *Hastula maryleeae* Burch, protoconch (AMNH 191815). Scale bars = 1 mm. af, accessory feeding apparatus; bc, buccal cavity; bt, buccal tube; lt, labial tube; pb, poison bulb; pe, pre-ganglionic esophagus; pg, poison gland; rc, radular caecum; rm, retractor muscle; rs, radular sac.

**Type locality:** Brazil, Rio Grande do Norte, sand island at mouth of the inlet at Areia Branca, 04°57'S, 37°08'W, G. & M. Kline et al., 14 December 1963.

**Holotype:** ANSP 299957, shell length 27.5 mm, width 6.7 mm.

**Paratypes:** Paratypes 1–20, ANSP 369293, from the type locality (15 dry, 5 in alcohol). Paratypes 21–22, UF 115180, from type locality. Paratypes 23–24, AMNH 129280, Brazil, Ceara, Acaraú, 02°53'S, 40°07'W.

**Distribution:** Presently known only from northern Brazil.

**Ecology:** Based on the locality label of the type lot, this species is found in sand near or at inlets much like some populations of *Hastula*. One specimen of *Hastula cinerea* (Born, 1778) was found in the type lot and another (AMNH 129269) from the same locality as the AMNH-

paratypes. Although these two species may occur microsympatrically, we assume there is no trophic competition due to the strikingly divergent feeding organs (see discussion).

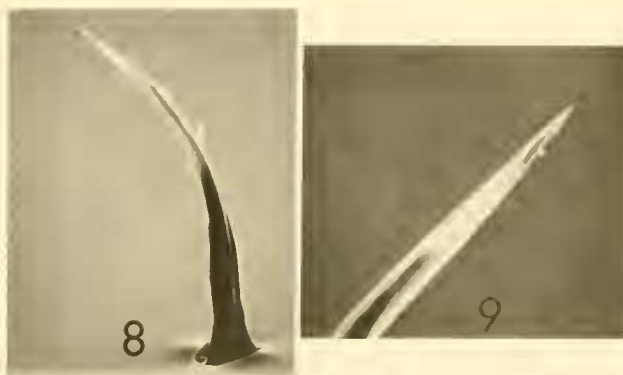
**Comparative remarks:** *Terebra imitatrix* is similar in shell morphology to the West Atlantic *Hastula cinerea* group. It can be easily separated from *Hastula cinerea* and *Hastula salleana* by the lack of spiral rows of pits and the generally more numerous, but less prominent, axial ribs. Although similar in size, *T. imitatrix* is usually broader anteriorly. *Hastula cinerea* and *H. salleana* have 3.5–4.0 protoconch whorls, while *T. imitatrix* has 1.5–2.0. The typical color pattern of *T. imitatrix* is more distinctly banded with larger and more distinct brown spots at the suture and a broader white subsutural band. *Terebra imitatrix* and *Hastula maryleeae* are more difficult to separate, particularly southern Caribbean pop-

ulations of *H. maryleeae* described as *Terebra tobagoensis* Nowell-Usticke, 1969, now placed in the synonymy of *H. maryleeae* by Bratcher and Cernohorsky (1987). Examination of the lectotype (AMNH 195453 designated by Bratcher and Cernohorsky, 1987:194, pl. 60, fig. 235c) and paralectotypes (AMNH 191819) of *T. tobagoensis*, as well as several other lots from Tobago, typical specimens of *H. maryleeae* from Texas, and specimens of a weakly ribbed form of *H. maryleeae* from the Dominican Republic (see Bratcher and Cernohorsky, 1987, for discussion) revealed consistent shell characters by which the two species may be separated. Anatomical features are discussed below. Typical *H. maryleeae* is easily separated from *T. imitatrix* by the distinctive shell shape caused by the enlarged nodes of the axial ribs at the suture and by the slight crenulations at the sutures of the upper whorls. *Hastula maryleeae* has a much smaller shell than *T. imitatrix* at the same whorl count (table 1). The shell of *T. imitatrix* broadens more anteriorly and has a proportionately slightly larger aperture. The protoconchs of both species have 1.5–2.0 whorls, however, the protoconch of *T. imitatrix* is more bulbous (figures 6, 7; table 1). Typical *T. imitatrix* also resembles the West African *Hastula aciculina* (Lamarck, 1822), particularly in color pattern. However, *T. imitatrix* lacks the supra-sutural groove and callosity found in *H. aciculina* (Bouchet, 1982; Bratcher and Cernohorsky, 1987).

## DISCUSSION

Miller (1970) proposed a division of the Terebridae into three major groups based on the anatomy of the foregut (feeding type) and later published a series of papers (Miller, 1971, 1975, 1979) on this subject supported by in-depth life history studies. These data are reviewed and the species assigned to each group are listed in Bratcher and Cernohorsky (1987). Type I species have a long labial tube and a short buccal tube. They do not possess a radular apparatus or poison organs. This group is further divided into two subgroups, IA and IB, based primarily on habitat and prey (see Bratcher and Cernohorsky, 1987). Type II encompasses species exhibiting typical toxoglossan feeding characters. The labial tube is long and eversible and the buccal cavity is relatively large. The buccal tube is long and retractile. They have a poison gland and bulb as well as a radular sac containing two rows of harpoon-like radular teeth. This feeding type is further divided into two subgroups, types IIA and IIB, based primarily on habitat and behavior. Type IIA includes several Indo-Pacific species, as well as the West Atlantic *Hastula* discussed in this paper (see Bratcher and Cernohorsky, 1987). Type III species possess an accessory feeding organ which grasps prey and pulls it into the labial cavity. They lack a radular apparatus and some have lost the buccal tube and salivary glands. This group presently contains no Atlantic species, but is represented by several Indo-Pacific taxa (see Bratcher and Cernohorsky, 1987).

*Terebra imitatrix* has very different foregut anatomy



Figures 8, 9. Radular teeth of paratype (ANSP 369293) of *Terebra imitatrix*, new species. 8. Whole tooth, 60  $\times$ . 9. Tip of tooth, 200  $\times$ .

from the West Atlantic *Hastula*. We have dissected *H. salleana* and *H. maryleeae* for comparison, and both possess a Type IIA polyembolic proboscis (Miller, 1970, 1971). *Terebra imitatrix* has a large spoon-shaped labial tube, presumably ineversible, a labial cavity dominated by the accessory feeding apparatus, an extremely short buccal tube incapable of extending outside the mouth and the buccal cavity, and the associated radular organs are minute in comparison to those of *Hastula*. The vestigial poison gland and bulb are barely recognizable as such and are considered homologous to the massive poison gland and bulb of *Hastula* only by the similarity of position and the site of its entrance into the buccal cavity. The radular teeth are similar in size and shape to those of *Hastula maryleeae* (0.15 mm). The teeth of *H. salleana* and *H. cinerea* are larger (0.5 mm) and barbed. The presence of an accessory feeding apparatus and the small size of other foregut organs place *T. imitatrix* near the group possessing a Type III polyembolic proboscis. However, the presence of radular and poison organs, such as occur in *T. imitatrix*, has not been reported for this proboscis type. Also, the shell of *T. imitatrix* is very different from the species in this group, all of which have shells with deeply impressed sutures, a sub-sutural groove and strong to moderate axial sculpture.

The feeding behavior of *Hastula cinerea* and of *H. inconstans* (Hinds, 1844) have been well documented by Marcus and Marcus (1960) and Miller (1979), respectively. The long eversible labial tube forages for prey items. A single radular tooth is passed through the labial tube, held in the tip, and inserted into the prey to facilitate penetration of the venom. The prey is then ingested via the labial tube. Miller (1970) suggests that species with a Type III proboscis forage by utilizing the accessory feeding apparatus, and that food items are passed into the opening of the interior buccal tube. We do not know if the radular and poison organs are functional in *Terebra imitatrix*. If so, the radular tooth is either transferred from the buccal tube to the accessory feeding apparatus and inserted into prey outside the body, or once it reaches the buccal tube.

The presence in *Terebra imitatrix* of the accessory feeding apparatus recorded in a few Indo-Pacific *Terebra* and the poison and radular organs of *Hastula* make this species unique. *Terebra imitatrix* may be closely related to the West African species, *Hastula aciculina*, however, this species must be studied anatomically before this assignment can be verified. Generic limits within the Terebridae are presently poorly understood with much overlap in shell and anatomical characters. Additional anatomical studies are needed to clarify the taxonomic and evolutionary significance of the foregut in the Terebridae.

#### ACKNOWLEDGEMENTS

We wish to thank several people who have assisted us during this study. Special thanks go to Robert Robertson, George M. Davis, and Mary A. Garback of the Academy of Natural Sciences of Philadelphia for allowing us to borrow and dissect the specimens on which this description is based. William K. Emerson, Harold Feinberg, and Walter Sage at the American Museum of Natural History allowed us to visit their department and borrow several lots of very pertinent material. Twila Bratcher of Hollywood, California kindly provided comparative material, as did Eliézar C. Rios (Fundação Universidade do Rio Grande do Sul, Brazil), the late Joseph Rosewater of the U.S. National Museum, and Thomas Pulley and Constance Boone of the Houston Museum of Natural Science. Marcos Guinaldo and Armando Garcia, Florida Museum of Natural History, prepared figures 4-7. The micrographs were made by the senior author with the scanning electron microscope housed in the Department of Zoology, University of Florida. In addition, we thank Richard S. Houbbrick, William K. Emerson, and Fred G. Thompson for reviewing earlier drafts of the manuscript.

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